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EVALUATION OF PROCESSING TOMATO BREEDING LINES AND CULTIVARS FOR MECHANICAL HARVESTING AND QUALITY IN 1980

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Tomatoes continue to be the most important processed crop in Ohio with a planted acreage of over 17 thousand acres and about 400,000 ton production, second only to California. New growing practices, machine harvest-bulk handling and new processing practices continue to create need for better suited varieties. This breeding work continues to be especially directed toward improvement of the whole-canned tomato (whole-pack), and other needs of the smaller canner in relation to this product. Emphasis is also placed on the development of improved types for use in the production of juice, sauce, and paste.

The breeding is directed toward increased productivity and more effective utilization of present yield, especially in regard to factors minimizing losses, due to overripe, rotted and green fruit.

With the increase in direct seeding, greater emphasis is being given to the incorporation of seed germination cold tolerance into new lines. Selection for earliness and good fruit setting ability, especially during periods of heat stress, is being carried out to reduce the problem of split fruit set so as to broaden and make possible more uniform delivery schedules. Other critically important characteristics being improved, especially for more effective machine harvest and bulk handling, include crack resistance, firmness and ability of ripe fruit to store well on the vine for extended periods for accumulation of a maximum amount of usable ripe fruit for once-over harvest. To reduce production costs, jointless pedicel (j2) is being incorporated to facilitate machine harvest and allow delivery of fruit free of stems.

Improved quality factors being selected for include: acidity, pH, soluble solids, viscosity, color [crimson fruit color (og^c) and high pigment fruit color (hp)] vitamin C, and especially fruit attributes conditioning efficient peeling characteristics and corelessness.

In 1980 there was an increase in commercial acreage planted of the machine harvest jointless pedicel (j2) cultivar Ohio 7663 for early-main season coreless whole-pack production. Field results continued good with it and the commercial pack had good quality with the fruit exhibiting excellent peeling characteristics and small core. It is anticipated that Ohio 7663 acreage will inincrease in the Midwest in 1981. Commercial size seed lots are available from ADI Distributors,

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Inc., Carmel, Indiana. In 1980 there was an increase in commercial acreage planted of the new cultivar Ohio 7681 as a product type tomato especially adaptable to juice production and for harvest by hand because of its large fruit size (1/4 pound) or harvest by machine because of fruit firmness, uniform ripening, concentration and ability to store on the vine in the field for extended periods. This line was named and released as Ohio 7681 in September 1980 and commercial size seed lots of this variety are also available from ADI Distributors, Inc.

OHIO 7681

Ohio 7681 is an F5 generation selection derived from the following five crosses and selections therefrom: (Ohio 2170 x Bouncer) x [(C28 x H1547) x Roma VF] x (C28 x 1547) . The line exhibited earliness comparable to C28 and productivity exceeding C28. Fruit size, concentration, uniformity of ripening and suitability for hand or machine harvest is excellent. It was evaluated in the Northern Tomato Exchange Program (NTEP) trials in 1978 and 1979 and in other tests as well as in the mid-west, Canada and Japan, all of which indicated that it has good adapatability and commercial potential.

Vines of Ohio 7681 are determinate (sp) and adapted to high population direct seed or transplant culture. Adequate foliage cover enables good quality fruit development, yet the vines become uniformly semi-prostrate at maturity resulting in good bed coverage, facilitating hand or machine harvest. Once-over yield has varied between 28 and 35 tons usable fruit per acre in replicated trials and over 30 tons per acre in commercial trial. Fruits of Ohio 7681 are approximately 3-4 1/2 ounces in size, blocky-deep-globe shaped and uniform ripening (ur).

The line is resistant to Verticillium albo-atrum (verticillium wilt) (Ve) and Fusarium oxysporum f. lycopersici Race 1 (fusarium wilt) (I). Resistance to radial and concentric fruit cracking along with firmness and good holding ability allows once-over machine harvest.

In experimental as well as commercial pilot trials Ohio 7681 raw product, as well as processed product is characterized by solids, acid and color equal to or better than standards. The new variety is adaptable to juice production and is also suitable for use in a variety of puree tomato products.

New Promising Ohio Advanced Breeding Lines

The advanced Ohio lines, O 7814, O 7864, O 7870, O 7868, O 7869, O 7986, O 79116, and O 8095 continued their good performance in 1980.

Ohio 7814, an early Fusarium resistant, jointless pedicel (j2), machine-harvest type, continued to exhibit good potential in Center as well as commercial trials. It has good firmness and holding ability with suitability for coreless wholepack as well as product. Seed has been increased and the line will be in extensive commercial trial acreage with several processors in 1981.

Ohio 7870 is an early-mainseason, freestemming, machine-harvest line which continues to show potential and especially good adaptability to a wide range of growing conditions. The line is Verticillium-Fusarium resistant, with good fruit size, firm and suitable for coreless wholepack or product. Some seed increase was possible with Ohio 7870 and it will be in further commercial trial acreage in 1981.

Ohio 7864 is also an early-mainseason, Verticillium-Fusarium resistant, machine harvest type line. It is suitable for product or coreless wholepack and will be continued in Center and commercial trial.

Ohio 7868 and Ohio 7869 are mainseason Verticillium-Fusarium resistant crimson (og^C) types which have exhibited potential in commercial trials for hand harvest, as well as machine harvest. They are firm and suitable for product or wholepack. They will be continued in Center and commercial trial.

Ohio 7986 is a mainseason, Verticillium-Fusarium resistant, freestemming line especially adapted to machine harvest and suitable for product and wholepack. It will be continued in trials.

Ohio 79116 and Ohio 8095 are machine-harvest types with high pigment (hp). They have performed with promise and will be continued in trial in 1981.

New breeding lines are available which exhibit potential for improved productivity and quality over present varieties (Tables 1 and 4). These lines will be further tested for commercial potential and are being used in further breeding to utilize higher levels of productivity and quality.

CULTURAL INFORMATION

Plants: Greenhouse-grown, 108 per standard flat from seed sown April 1.

Transplanted to Field: May 27, a two-row transplanter using 21-53-0 starter at 5 lb. per 100 gal. of water; 1/2 pint per plant.

Fertilizer: 800 lb. per acre of 6-24-24 May 1.

Soil: Silty clay loam, fall bedded October 18.

Herbicide: Enide 8#/A 2 weeks after transplanting.

Plot Size and Spacing: One-row plots, 20 plants per row spaced 12 inches, rows 5 feet apart. Three replications.

Irrigation: None applied.

Insect and Disease Control: Air blast sprayer application according to recommendation as follows:

June 11	Guthion & Copper
June 18	Guthion & Copper
June 24	Thiodan & Copper
July 2	Sevin & Copper
July 9	Sevin & Manzate 200
July 18	Guthion, Copper & Manzate 200
July 24	Thiodan, Manzate 200 & Bravo
August 1	Thiodan, Manzate 200 & Bravo
August 9	Manzate 200 & Bravo
August 23	Bravo & Benalate

Weather Data (Fremont, Ohio)

	Temperature		Rainfall (inches)	
	1980	26 Year Avg.	1980	26 Year Avg.
May	60.4	58.8	2.71	3.30
June	66.2	68.1	3.78	3.83
July	73.5	72.2	4.63	4.14
August	73.5	70.4	6.91	3.72
September	64.7	64.2	0.05	2.85

Spring weather was wet and cool. Planting conditions improved during May with above average temperature; above average rainfall conditions persisted. June had below average temperature, but above average temperature was experienced in July and this persisted into August along with the above average rainfall. There was some blossom loss and split set. High temperatures accelerated ripening but excess soil moisture increased losses from fruit rot. September temperature was above average, with only a trace of rainfall.

QUALITY EVALUATION

Field run tomatoes were used for quality evaluation; the sample was cut in half, quartered, extracted in a Food Processing Equipment Co. Laboratory pulper, and de-aerated.

1. Hunter color and Color Different Meter; standardized with L-25.59, aL-27.40 and bL-12.54 plates.

2. Agtron E-5. Instrument calibrated at 48.

3. Hunter D-6 Tomato colorimeter (TCM).

4. Percent Soluble Solids. Abbe Refractometer.

5. Percent total acid as citric. The raw sample used for pH determination was directly titrated using 0.1 normal sodium hydroxide solution to a pH of 8.1.

6. pH was determined by the glass electrode method.

7. Vitamin C (ascorbic acid) standard procedure:

$$\text{Dye factor} \times \text{ml. of dye} \times 100 - \frac{\text{mgs. Vitamin C}}{\text{100 gms}}$$

TABLE 1. Trial I. Field Evaluation of Processing Tomato Varieties and Test Lines for Mechanical Harvest When Yields of Marketable Fruit Were Approaching Optimum Recovery, Vegetable Crops Branch, OARDC, Fremont, Ohio 1980.

Variety or Test Line	Seed Source	Ripe Usable Tons/A	Ripe Usable % of Potential	% of Potential Cull	Fruit Size (oz)	Stems %	Stems Joint	Disease Resistance
Harvest Date 8/28/80								
O 8035	1	26.1	78	7	2.7	0	j2	F
O 7874	1	23.0	63	2	2.8	1	j2	V-F
Heinz 2653	6	22.1	73	4	2.4	1	j2	V-F
O 7893	1	20.0	75	3	2.5	0	j2	V-F
O 8038	1	19.4	81	4	2.4	0	j2	V-F
Peto 80	10	18.2	77	4	2.5	7	+	V-F
Heinz 727	6	16.6	74	7	2.6	2	j2	V-F
Harvest Date 9/3/80								
O 7825	1	35.4	82	7	2.5	52	+	F
Ohio 7663	1	30.9	83	7	3.2	5	j2	F
Ohio 7681	1	28.7	78	12	4.8	83	+	V-F
Hunts 304	5	28.5	80	8	3.0	5	+	V-F
Campbell CX793	3	26.5	74	14	3.6	0	j2	F
Campbell CX796	3	25.1	75	13	3.3	3	j2	F
Ohio 8036	1	25.1	84	11	2.8	2	j2	F
O 7955	1	23.2	86	7	2.7	6	+	V-F
O 7986	1	22.6	75	9	3.2	7	+	V-F
Harvest Date 9/8/80								
Ohio 7870	1	39.1	88	5	3.5	25	+	V-F
Heinz 722	6	31.6	83	8	2.7	0	j2	V-F
O 7868	1	30.9	84	8	3.6	33	+	V-F
Heinz 414	6	30.3	81	12	3.2	3	j2	V-F
Heinz 2867	6	30.2	80	7	2.9	0	j2	V-F
Peto 81	10	27.9	79	13	3.3	6	+	V-F
VF 134-1-2	10	22.0	78	13	3.1	7	+	V-F
Harvest Date 9/11/80								
O 7869	1	30.0	81	9	4.1	83	+	V-F
O 7855	1	28.4	81	10	3.2	22	+	V-F
Campbell 37	3	27.5	80	15	3.4	2	j2	F
LSD 5%		5.3	8	4	0.4	9		

TABLE 2. Trial I. Laboratory Evaluation of Processing Tomato Varieties and Test Lines, Vegetable Crops Branch, OARDC, Fremont, Ohio, 1980.

Variety or Test Line	pH	% Citric acid	% Soluble solids	Color				Vit. C
				L	Hunter CDM a/b	Agtron E5	Hunter D6 TCM	
O 8035	4.10	0.43	4.5	23.98	2.86	29.0	78.8	15.9
O 7874	4.25	0.38	5.0	26.67	2.81	30.5	79.8	15.9
Heinz 2653	4.20	0.36	3.8	25.83	2.51	33.0	72.1	14.0
O 7893	4.05	0.48	4.6	23.62	2.91	30.0	80.5	15.3
O 8038	3.95	0.43	4.4	24.77	2.74	32.0	76.1	14.0
Peto 80	4.10	0.36	4.6	26.01	2.49	31.0	71.8	12.2
Heinz 727	4.30	0.34	3.6	24.17	2.75	31.0	78.0	13.4
O 7825	4.12	0.37	3.6	23.61	2.85	30.0	80.2	15.9
Ohio 7663	4.10	0.40	4.8	25.12	2.64	32.0	74.7	13.4
Ohio 7681	3.95	0.33	3.6	24.87	2.59	33.0	75.2	14.6
Hunts 304	4.30	0.37	4.0	24.11	2.81	29.5	78.5	12.8
Campbell CX793	4.10	0.40	3.5	23.84	2.63	30.0	78.7	12.8
Campbell CX796	4.25	0.37	3.6	22.84	2.61	30.5	80.2	14.6
Ohio 8036	4.02	0.43	3.9	23.75	2.88	29.0	80.0	15.3
O 7955	4.05	0.38	4.4	23.20	2.93	29.0	81.8	15.9
O 7986	4.08	0.40	4.0	24.05	2.84	31.0	78.7	15.3
Ohio 7870	4.00	0.45	4.7	23.52	2.85	30.0	80.5	14.0
Heinz 722	4.20	0.38	4.3	27.29	2.47	35.0	----	----
O 7868	4.15	0.35	4.5	23.33	3.12	29.0	82.1	15.3
Heinz 414	4.10	0.38	3.9	23.66	2.86	29.5	80.0	16.5
Heinz 2867	4.20	0.39	3.8	24.10	2.93	30.0	78.8	14.0
Peto 81	4.40	0.39	3.9	24.98	2.70	29.1	75.4	11.6
VF 134-1-2	4.20	0.44	4.3	25.25	2.67	29.5	74.7	10.4
O 7869	4.00	0.38	3.8	23.06	3.09	28.5	82.9	13.4
O 7855	4.10	0.36	4.7	24.60	2.46	29.0	75.4	15.3
Campbell 37	4.20	0.39	3.5	24.00	2.64	30.0	78.2	12.2

TABLE 3. Trial II. Field evaluation of Processing Tomato varieties and Test Lines for Mechanical Harvest When Yields of Marketable Fruit Were Approaching Optimum Recovery, Vegetable Crops Branch, OARDC, Fremont, Ohio 1980.

Variety or Test Line	Seed Source	Ripe Usable Tons/A	Ripe Usable % of Potential	% of Potential Cull	Fruit Size (oz)	Stems %	Stems joint	Disease Resistance
Harvest Date 8/28/80								
Ohio 7814	1	27.1	81	4	2.3	0	j2	F
O 7983	1	26.6	74	3	2.1	0	j2	F
O 8095	1	26.3	68	7	3.8	3	j2	F
O 8075	1	21.6	81	6	2.0	0	j2	V-F
O 7982	1	20.7	75	3	2.1	0	j2	F
Heinz 2653	6	20.2	86	5	2.3	1	j2	V-F
Harvest Date 9/3/80								
O 7981	1	36.6	82	8	2.5	0	j2	F
O 7864	1	34.7	78	6	3.4	6	+	V-F
Hunts 304	5	34.1	81	5	3.2	9	+	V-F
O 7630	1	30.7	71	7	4.3	68	+	V-F
O 79116	1	27.1	75	9	2.2	3	j2	V-F
O 8084	1	26.8	80	6	2.5	3	j2	F
O 8087	1	25.6	79	9	2.5	0	j2	F
Harvest Date 9/8/80								
O 79117	1	33.3	75	7	2.6	1	j2	V-F
O 79118	1	31.8	76	11	2.5	1	j2	V-F
Heinz 722	6	28.2	84	8	2.4	1	j2	V-F
Harvest Date 9/11/80								
O 8094	1	25.2	80	10	2.5	1	j2	F
LSD 5%		5.2	8	4	0.5	15		

TABLE 4. Trial II. Laboratory Evaluation of Processing tomato Varieties and Test Lines. Vegetable Crops Branch, OARDC, Fremont, Ohio 1980.

Variety or Test Line	pH	% Citric acid	% Soluble solids	Color				
				Hunter			Hunter	
				L	CDM a/b	Agtron E5	D6 TCM	Vit. C
Ohio 7814	3.95	0.49	3.9	24.07	2.81	30.5	78.6	15.3
O 7983	4.10	0.56	3.1	23.84	2.93	30.0	79.7	12.2
O 8095	4.30	0.38	4.1	23.20	3.03	29.0	82.2	23.0
O 8075	4.10	0.39	3.9	25.56	2.62	32.0	73.5	10.0
O 7982	4.00	0.45	2.7	23.49	2.92	29.0	80.9	15.9
Heinz 2653	4.20	0.39	3.0	24.18	2.72	30.0	77.9	18.3
O 7981	4.00	0.43	2.8	23.66	2.91	30.0	80.3	13.1
O 7864	4.00	0.36	4.0	23.82	2.98	28.0	80.0	14.0
Hunts 304	4.05	0.42	3.0	24.26	2.78	30.0	77.9	15.9
O 7630	4.00	0.49	3.9	23.43	2.80	33.0	80.7	15.3
O 79116	3.90	0.56	4.0	23.04	3.22	27.0	83.6	12.5
O 8084	4.20	0.50	4.4	23.97	2.97	33.0	79.4	17.2
O 8087	4.20	0.47	4.6	24.22	2.90	32.0	78.2	18.0
O 79117	4.05	0.31	3.8	22.84	3.08	30.0	84.0	14.0
O 79118	3.95	0.46	3.2	23.05	3.19	28.0	83.4	14.6
Heinz 722	4.00	0.44	4.5	23.95	2.85	31.0	79.2	14.6
O 8094	4.20	0.41	3.9	22.59	3.26	29.0	85.3	23.0

TABLE 5. Evaluation of 1980 N.T.E.P. (Northern Tomato Exchange Program), OARDC, Wooster, Ohio
(Rating Score: 5 Excellent - 1 Poor)

NTEP Entry No.	Cultivar	Source	Earliness	Cover	Set Concentration	Fruit Size	Firmness	Separation	Styler scar	Internal color	Coreless Whole-pack
8001	Ont 7616B	8	4	3	5	2	4	4	5	4	5
8002	PU 80A04	14	1	4	5	3	3	3	5	3	5
8003	79B38	13	1	5	5	4	3	3	5	3	3
8004	Ont 781	8	3	4	3	3	4	3	5	5	2
8005	80NC109	7	3	4	5	4	3	5	5	3	5
8006	Ohio 7870	1	3	4	5	3	3	3	5	3	5
8007	H 722	6	3	2	5	4	4	5	5	3	5
8008	Md 155	2	2	5	3	3	4	3	5	2	4
8009	79B35	13	3	3	5	4	4	5	5	3	4
8010	ST 52	9	4	2	3	5	4	4	5	4	2
8011	Ohio 7868	1	4	3	5	4	4	3	5	4	4
8012	79B9	13	2	5	4	4	4	5	4	3	5
8013	Ont 7920	8	4	4	3	4	5	5	5	2	5
8014	PU 80A41	14	5	3	5	3	4	4	5	3	5
8015	Ont 777E	14	4	4	3	5	3	3	3	4	4
8017	ST 51	9	4	4	3	3	4	5	4	3	5
8018	H 727	6	5	3	5	3	3	3	5	3	4
8019	Md 149	2	3	3	4	3	4	4	5	3	5
8020	Ont 7924	8	4	3	3	4	5	3	5	3	5
8021	Md 153	2	2	5	5	3	3	5	5	3	4
8022	Ohio 7955	1	4	3	4	3	4	5	3	4	5
8023	TH 318	6	4	2	5	4	3	3	5	4	3
8024	Md 151	2	3	5	4	3	3	5	5	3	5
8025	PU 80A26	14	2	5	5	4	4	5	5	3	5
8027	ST 48	9	4	2	5	4	3	3	5	2	3
8029	Ohio 7814	1	3	4	5	3	4	4	4	3	5
8030	Md 154	2	2	5	5	3	4	5	5	3	5
8032	79B6	13	4	4	4	3	4	5	5	2	4
8033	Ohio 7864	1	3	3	4	4	4	5	5	3	5

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